

## THE VALUE OF SWEET CHESTNUT *CASTANEA SATIVA* AS A FOODPLANT FOR LEPIDOPTERA

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### Abstract

Sweet Chestnut is a non-native tree in Britain and is considered to have a low biodiversity value. However, over seventy species of Lepidoptera have now been recorded utilizing Sweet Chestnut as a foodplant, demonstrating it to be an under-valued and important hostplant.

### Introduction

Sweet Chestnut *Castanea sativa* is a historic, but not native member of our flora (Rackham, 1986) and was probably introduced by the Romans (Preston, Pearman & Dines, 2002). By the Middle Ages it was known to be a tree of woodlands and generally associated with oak *Quercus* spp. and Beech *Fagus sylvatica*. From the late seventeenth century onwards, and especially in the nineteenth century, Sweet Chestnut woods were planted, particularly in south-east England, as a source of poles, such as those used by hop growers. Now it is a significant constituent of coppiced woodland in south-east England and is also planted in hedgerows, wood borders, parkland and amenity areas and in large gardens. Preston, Pearman & Dines (*loc. cit.*) attribute a large, comparatively recent, increase in records to improved recording and continued planting. It is now widely distributed over the southern half of England and Wales, becoming more thinly distributed in northern England and Scotland. By 2004 there were 12,000ha of Sweet Chestnut in England, 1000ha in Wales with none in Scotland (Forestry Statistics, 2004, Economics and Statistics Division, Forestry Commission, Edinburgh).

Sweet Chestnut has generally been considered of little interest to lepidopterists and has been thought to be of little significance as a hostplant, for example Kennedy & Southwood (1984) cite 11 species of phytophagous insect, nine of these Lepidoptera, associated with Sweet Chestnut. Young (1997) suggests that there is an expectation that native species should have more herbivores than non-natives and that this is generally the case, although this difference is not always as marked as would be expected. Young (*loc. cit.*) gives the number of moth species feeding on Sweet Chestnut as ten and suggests that this tree has the fewest number of species associated with it other than Holly *Ilex aquifolium* and Yew *Taxus baccata*. In the light of recent publications and additional studies it is now timely to review this concept.

### Sources of data

#### **i. Exotic broadleaved trees study by R.C. Welch and N. Greatorex-Davies**

During the years 1979 to 1983 a study of the phytophagous insect fauna of a selection exotic tree species and related native tree species was carried out in

southern England (Welch & Greatorex-Davies, 1993). The purpose of the study was to investigate the colonising fauna of these trees and the potential for insect pests should the trees become more widely planted. Initially the study focused on species of the southern hemisphere genus *Nothofagus*, collectively known as southern beech. Other species of Fagaceae were sampled for comparison including oak, Beech and Sweet Chestnut. The latter was first sampled in 1980, but these occurred in mixed stands and undoubtedly some of the Lepidoptera in the samples were contaminants from adjacent oak and Beech so these data are not considered here.

In 1981 several sites in southern England were selected where Sweet Chestnut grew in more or less pure stands. The sites were Challock Forest in Kent, Forty Acre Wood near Billericay in Essex, and Yorkley Slade and Clanna Woods in the Forest of Dean. Some additional sampling was also undertaken in 1982. At each site the lower branches of Sweet Chestnut were sampled for insects, using a standard Bignell beating tray, in late May/June and again in September. Branches sampled were those low enough to be reached from the ground or from a small stepladder. Each sample consisted of 25 sub-samples. Species and numbers of insects that fell onto the beating tray were recorded or retained for later identification.

Lepidoptera larvae were retained and reared on Sweet Chestnut both to confirm identity where necessary and to observe whether they fed on the leaves and subsequently successfully produced adult moths. Some larvae were almost full-grown when collected and for these it was assumed that they had successfully reached that stage feeding on Sweet Chestnut. Larvae found under the bark of dead branches of Sweet Chestnut at Yorkley Slade were also reared.

## ii. The Waved Carpet *Hydrelia sylvata* (Denis & Schiffermüller) study

As part of the UK Biodiversity Action Plan, Butterfly Conservation was given Lead Partner status for the majority of the moths, including the Waved Carpet *Hydrelia sylvata*. The broad objectives of the plan for this species are to maintain its range and to enhance the overall population size in each occupied area. These objectives are to be met through encouraging appropriate woodland management (UK Biodiversity Group 1999). This required investigation into coppice management and habitat suitability.

In 2000, Forest Research provided contributory funding to examine the autecology and habitat preferences of the Waved Carpet, funding which was continued until 2003. Further study was also undertaken by Butterfly Conservation staff in 2004. By 2002, Rewell Wood, West Sussex, had been identified as a key site to study this species in a coppice environment, due to a high local population of the moth, a large, well and regularly managed Sweet Chestnut coppice, with coppice blocks of almost pure Sweet Chestnut, and a well documented management history.

West (1983) reports finding larvae of the Waved Carpet on Sweet Chestnut in Kent. Given the high populations of the moth at Rewell Wood around the Sweet

Chestnut coppice, for example nearly 70 were recorded over two nights in 2001 (Clancy, 2002), it was considered highly probable that the larvae were feeding predominantly on this tree. In order to determine its larval requirements, searches were conducted for larvae feeding on Sweet Chestnut. In addition to active searching for larvae, a standard Bignell beating tray was used. All larvae found feeding on Sweet Chestnut were identified and recorded. These larval searches were undertaken by MSP, Sean Clancy, Susan Clarke, Tony Davis and David Green and reported in Clarke (2004).

### iii. Other sources

Recent literature sources were trawled for species associated with Sweet Chestnut. These were Emmet (1988), Waring, Townsend & Lewington (2003) and Emmet & Langmaid (2002). A few lepidopterists were also contacted and asked for further data.

**NOTE:** *Caloptilia leucapennella* is given in Clarke (2004): This species was a transcription error and should have been *Bucculatrix demaryella* (D. Green, pers. comm.). The case of *Taleporia tubulosa* (Psychidae) has also been found on Sweet Chestnut trunks, but the larva probably feeds on the algae on the tree trunk.

## Discussion

The results of this review show that 72 species of Lepidoptera have now been recorded feeding on Sweet Chestnut (Table 1). During the various searches undertaken at Rewell Wood it was clear that larvae appeared to be at low density on Sweet Chestnut. However, only those branches that were accessible were beaten and it is possible that those branches higher up and beyond easy reach could have supported more larvae. Also the number of larvae found does not correspond well with the number of adult moths recorded at individual mercury vapour 125 watt traps run in the middle of Sweet Chestnut coppice blocks (almost pure stands) for another aspect of the Forest Research study. For example, on 25 June 2003, Mottled Beauty *Alcis repandata*, Brindled White-spot *Parectropis similaria* and Light Emerald *Campaea margaritata* were found in numbers as an adult, 272, 46 and 39 respectively (Clarke, 2004), indicating that the larvae of these were either overlooked or the adults came from elsewhere. The latter possibility is considered unlikely due to the nature of the individual trap sites and also would not explain the differences in catches observed between the various age classes of the coppice blocks. For example, 29.9% of the total *A. repandata* found on 4 July 2002 (from figures derived from Clarke, 2003) in one of the older coppice blocks compares favourably with 29.7% of the total found on 25 June 2003 and 25% found on 6 July 2004 in the same coppice block, when comparing the six trap sites that were run in every year. These differences between coppice blocks suggest that individual age classes of coppice are more suitable for some species than others and would also indicate that larvae were overlooked.

The diversity of species found as larvae does compare more closely with several of the more numerous species found as adults at the light traps in June and July. For example, on the 25 June 2003, 211 species (not including species aggregations) were recorded at eight light traps run within the coppice stands of between two and 20 years of age (Clarke, 2004). The larval foodplants of many of the moths recorded are grasses, herbs and algae etc., but of those that fed on deciduous trees, 74 species of moth were recorded. Of this total 28 (nearly 40%), have been found feeding on Sweet Chestnut as a larva.

Amongst the larvae found on Sweet Chestnut are several species of conservation significance, such as the Waved Carpet *Hydrelia sylvata*, the Scarce Merveille du Jour *Moma alpium*, the Olive Crescent *Trisateles emortalis* and *Oecophora bractella*, along with several other scarce and local species, including the gelechiid *Teleiodes wague* and Brindled White-spot *P. similaria*. From their occurrence in woodland habitats, particularly where Sweet Chestnut is prevalent, we strongly suspect that there are several other species yet to be found associated with Sweet Chestnut, including further species of conservation concern, such as Clay Fan-foot *Paracolax tristalis* and White-line Snout *Schrankia taenialis*, both UK BAP Priority species.

Combining the number of macro-moth and micro-moth species associated with various tree species, using Waring, Townsend & Lewington (2003) and Emmet (1988) respectively, shows that the total of 72 species feeding on Sweet Chestnut is similar, even when removing the nine species found as single larvae, to the figures for trees such as elm *Ulmus*, including Wych Elm *U. glabra* (69 species), alder *Alnus* spp., predominantly *glutinosa* (68), Aspen *Populus tremula* (63) and Beech *Fagus sylvatica* (41), and is considerably more than lime *Tilia* spp.(36) and natives such as Hornbeam *Carpinus betulus* (34), Field Maple *Acer campestre* (29), Ash *Fraxinus excelsior* (26), although these figures may well under-represent the palatability of these species.

Although likely to be an underestimate, Young (1997) gives 119 species as associated with oak. Fifty-four of the species listed in Table 1 have been recorded feeding on oak, while 12 species will also feed on Beech. Sweet Chestnut, oak and Beech are all members of the Fagaceae. This taxonomic relationship, with the assumption that these related trees are likely to share chemical and physical features, make it more likely that these moths will switch to a more closely related hostplant (Connor et al, 1980), combined with Sweet Chestnut being known as tree of woodlands since at least the Middle Ages and generally found associated with oak and Beech, may help to explain this observation.

Table 1. Lepidoptera species recorded feeding on Sweet Chestnut *Castanea sativa*.

	Emmet (1988)	Waring, Townsend & Lewington (2003)	Clarke (2004)	Welch & Greares-Davies study	Other sources	Comments
<b>Nepticulidae</b>						
<i>Stigmella ruficapitella</i>						
<i>Stigmella samiatella</i>	+		+		+ (C. W. Plant, pers. comm.)	
<b>Tischeriidae</b>						
<i>Tischeria ekebladella</i>	+			+		
<i>Tischeria dodonaea</i>	+					
<b>Bucculatricidae</b>						
<i>Bucculatrix demaryella</i>	+				+ (D. Green, pers. comm.)	
<b>Gracillariidae</b>						
<i>Phyllonorycter messaniella</i>	+		+	+		
<b>Sesilidae</b>						
Yellow-legged Clearwing <i>Synanthedon vespiformis</i>		+			+ (J. Clarke, pers. comm.)	Nationally Scarce
<b>Yponomeutidae</b>						
<i>Agyresthia glaucinella</i>				+	+ (D. Green, pers. comm.)	In living bark
<i>Ypsolopa parenthesesella</i>				+		A single larva found
<i>Ypsolopa ustella</i>						A single larva found
<b>Oecophoridae</b>						
<i>Oecophora bractella</i>				+		Larvae found under the bark of dead branches; pRDB 3 (Rare)
<i>Carcina quercana</i>	+					
<i>Diurnea fagella</i>				+	+ (D. Green, pers. comm.)	



	Emmet (1988)	Waring, Townsend & Lewington (2003)	Clarke (2004)	Welch & Greatorex- Davies study	Other sources	Comments
<b>Gelechiidae</b>						
<i>Teledodes wagaie</i>					+ (Emmet & Langmaid, 2002)	Nationally Scarce
<b>Tortricidae</b>						
<i>Pandemis cerasana</i>				+		
<i>Pandemis cinnamomeana</i>				+		A single larva found
<i>Syndemis musculana</i>					+ (J. Langmaid, pers. comm.)	A single larva found
<i>Eulia ministrana</i>			+			
<i>Tortrix viridana</i>				+		
<i>Pammene fasciana</i>	+					
<i>Cydia splendana</i>	+					
<i>Cydia pomonella</i>	+					
<b>Pyralidae</b>						
<i>Agrotera nemoralis</i>	+					
<b>Lasiolepididae</b>						
Oak Eggar						
<i>Lastocampa quercus</i>			+			
<b>Geometridae</b>						
March Moth						
<i>Aksophila aescularia</i>				+		
Common Emerald						
<i>Hemithea aestivaria</i>			+	+		
Little Emerald						
<i>Jodis lactearia</i>		+	+	+		
Clay Triple-lines						
<i>Cyclophora linearia</i>				+		A single larva found

	Emmet (1988)	Waring, Townsend & Lewington (2003)	Clarke (2004)	Welch & Greatorex-Davies study	Other sources	Comments
Broken-barred Carpet <i>Electrophaes corylata</i>				+		A single larva found
Winter Moth <i>Operophtera brumata</i>				+	+ (D. Green, pers. comm.)	
Satyr Pug <i>Eupithecia satyrata</i>			+			A single larva found
Grey Pug <i>Eupithecia subfuscata</i>					+ (D. Green, pers. comm.)	
Waved Carpet <i>Hydrelia sylvata</i>		+	+			UK BAP Priority
Scorched Wing <i>Plagodis dolabraria</i>		+				
Brimstone <i>Opisthograpta luteolata</i>			+			
Early Thorn <i>Selenia dentaria</i>				+		A single larva found
Purple Thorn <i>Selenia tetralunaria</i>			+			
Scalloped Hazel <i>Odonoptera bidentata</i>			+	+		
Feathered Thorn <i>Calotis pennaria</i>					+ (D. Green, pers. comm.)	
Small Brindled Beauty <i>Apocheima hispidaria</i>		+		+		
Pale Brindled Beauty <i>Phigalia pilosaria</i>				+		
Peppered Moth <i>Biston betularia</i>		+	+	+		
Scarce Umber <i>Agrotis aurantaria</i>				+		

	Emmet (1988)	Waring, Townsend & Lewington (2003)	Clarke (2004)	Welch & Greatorex-Davies study	Other sources	Comments
Dotted Border			+			
<i>Agriopsis marginaria</i>						
Mottled Umber		+		+		
<i>Erannis defoliaria</i>						
Mottled Beauty			+	+		
<i>Alcis repandata</i>						
Pale Oak Beauty			+			
<i>Hymomecis punctinalis</i>						
Engrailed <i>Ectropis bistortata</i>			+	+		
Brindled White-spot						
<i>Paractropis similaria</i>			+			
Common White Wave						
<i>Cabera pusaria</i>			+	+		
Light Emerald						
<i>Campaea margaritata</i>		+	+	+		
<b>Notodontidae</b>						
Buff-tip <i>Phalera bucephala</i>			+	+		
Coxcomb Prominent						
<i>Ptilodon capucina</i>			+	+		
<b>Lymantriidae</b>						
Vapourer <i>Orgyia antiqua</i>			+			
Pale Tussock						
<i>Calliteara pudibunda</i>			+	+		
Yellow-tail <i>Euproctis similis</i>			+			
<b>Noctuidae</b>						
Pale-shouldered Brocade						
<i>Lacanobia thalassina</i>				+		



	Emmet (1988)	Waring, Townsend & Lewington (2003)	Clarke (2004)	Welch & Greatorex-Davies study	Other sources	Comments
Small Quaker <i>Orthosia cruda</i>				+		
Common Quaker <i>Orthosia cerasi</i>				+	+ (D. Green, pers. comm.)	
Clouded Drab <i>Orthosia incerta</i>				+		
Twin-spot Quaker <i>Orthosia munda</i>				+		
Hebrew Character <i>Orthosia gothica</i>			+	+		
Satelite <i>Eupsilia transversa</i>			+	+		
Chestnut <i>Conistra vaccinii</i>				+		
Scarce Merveille du Jour <i>Moma alpinum</i>		+	+			A single larva found. UK BAP Priority
Grey Dagger <i>Acronicta psi</i>			+			
Copper Underwing <i>Amphipyra pyramidea</i>				+		
Dun-bar <i>Cosmia trapezina</i>			+	+		
Bordered Sallow <i>Pyrrhia umbra</i>			+			
Green Silver-lines <i>Pseudaips prasinana</i>		+	+			
Nut-tree Tussock <i>Colocasia coryli</i>			+	+		
Olive Crescent <i>Trisateles emortualis</i>		+			+ (J. Clarke, pers. comm.)	Associated with old and decaying leaves of Sweet Chestnut. UK BAP Priority

### Conclusions

The diversity of species found as larvae would indicate that Sweet Chestnut is indeed an important, and perhaps under-valued, hostplant for moths. Moreover, several scarcer species were found, demonstrating the conservation potential of Sweet Chestnut. It could be that the long term residence of this tree in Britain and widespread planting of the species, at least in south-east England, combined with the local abundance and its frequent close association, and taxonomic relationship with oak and Beech has led to many moth species to find Sweet Chestnut a palatable alternative host.

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### **A new food-plant for *Rhigognostis incarnatella* (Steudel, 1873) (Lep.: Yponomeutidae) in Scotland**

The status of *Rhigognostis incarnatella* (Stdl.) as a native versus naturalised species in Scotland has often been discussed by Scottish entomologists. On several occasions in Scotland *R. incarnatella* has been reared from or captured close to *Hesperis matronalis* (Dame's violet) – a non-native garden escape. However singletons have often been taken in an upland or pinewood context far away from any stands of *Hesperis* either in or out of gardens. Its food-plant in such situations has been a source of some speculation but *Alliaria petiolata* (Garlic Mustard) (see Emmet, A.M. (1991. Chart showing the Life History and Habits of British Lepidoptera, *Moths and Butterflies of Great Britain and Ireland* **7**(2): 105) could not be a candidate. The species has now been reared from a larva feeding on *Draba incana* (Hoary Whitlowgrass) growing at 600m a.s.l. on a crag in the Breadalbane Hills thus solving the enigma of its “wild” food-plant and reinforcing its native status.

On 24.v.2005 a single small green larva was found feeding on the central shoot of a plant of *Draba incana* growing on a rocky ledge on the crags above Lochan an Lairige, (O. S. grid reference NN 5939), Meall nan Tarmachan, Perthshire (VC 88). There was no apparent silk present, and the larva was feeding exposed on the upperside of the leaf. It was at first mistaken for a first or second instar noctuid larva, but on 7.vi.2005 it spun a boat-shaped open net-work cocoon, typical of a plutelline. Emergence of a slightly deformed imago occurred on 27.vi.2005.— K. P. BLAND, National Museums of Scotland, The Granton Centre, 242 West Granton Road, Edinburgh EH5 1JA.